Space Weather Technical Forecast

Issued on Thursday, 02 June 2022 at 01:16 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

---

Space Weather Forecast Headline: Active Electron Fluence. Slight chance of R1/R2 Radio Blackouts.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Very Low, with no significant activity. There are currently four numbered sunspot regions on the Earth-facing disc. The most notable is AR3026 Dai/Beta which has rapidly grown in the last 12 hours, and was the source of a B8.7 flare at 01/1147 UTC, although this region currently remains relatively small and magnetically simple. AR3025 has now rotated off the disc and around the western limb, while the other regions are smaller, simple and mostly stable. However, newly numbered AR3027 in the southeast has continued to show some growth, which is now classified as a Dao/Beta configuration. Meanwhile, a central disc filament eruption was observed to have an associated coronal dimming, with a weak and slow CME seen in available imagery. This has been analysed and may give a slight chance of a glancing blow late on day 4 (5th June). No other Earth-directed CMEs have been observed in the last 24 hours.

Solar Wind / Geomagnetic Activity: The solar wind, as observed by DSCOVR at L1 has gradually declined from 527km/s to around 400km/s, after disconnecting from the recent coronal hole fast wind. Density has been close to average, but also declined to below average around 01/0640 UTC. The interplanetary magnetic field strength, Bt, has been weak, below 6nT, with the north-south component, Bz, varying weakly between -4 and +4nT, but predominately in the negative direction. Phi angle was predominantly negative (towards the Sun). Geomagnetic activity was Quiet.

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV) has been at background levels. The high energy electron flux (greater than 2 MeV) varied between moderate and high levels, reaching 6870 pfu at 01/1510 UTC. Electron fluence has been above the Active threshold reaching 2.77e8 integrated pfu at 02/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be Very Low, with a chance of rising to Low and a slight chance of rising to Moderate, primarily due to the rapidly developing sunspot AR3026 in the northwest, and the continuing development of AR3027 in the southeast. This brings a slight chance of R1-R2 Radio blackouts.

Solar Wind / Geomagnetic Activity: There is the slight chance of a weak Earth-directed CME from a filament eruption arriving late on day4 (5th June), although confidence is low. Otherwise, solar winds are expected to remain at background levels throughout the period. Geomagnetic activity is forecast to be mostly Quiet, but with a slight chance of an Unsettled or Active interval from a weak CME, which may give a glancing blow late on day 4 (5th June).

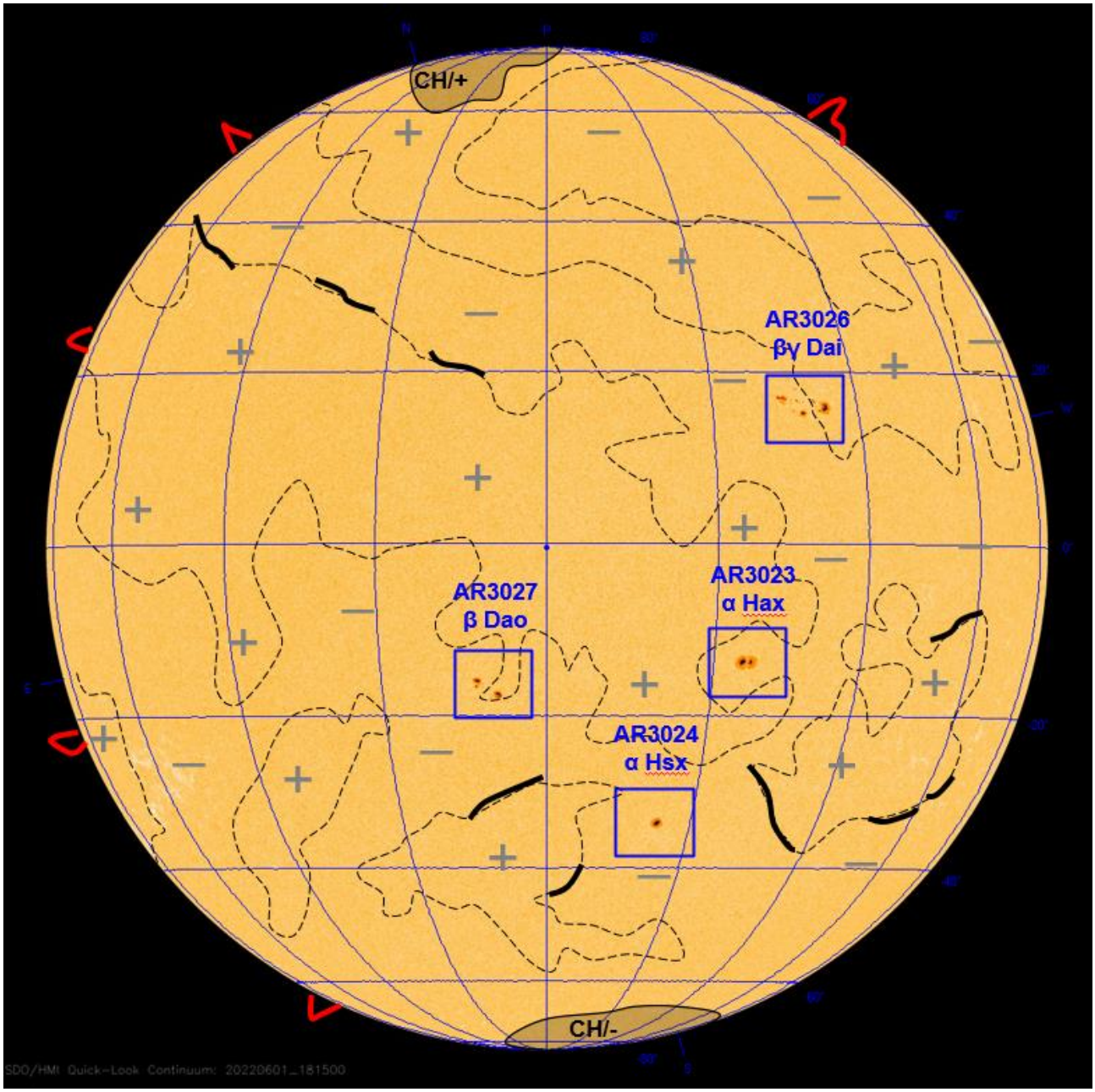
Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) is

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

expected to be at background levels during this period. High energy electron flux (greater than 2MeV) is likely to continue at mainly High levels, with peak values only gradually easing later in the period. Electron fluence levels are expected to be Active throughout (1e8 integrated pfu), but likely declining a little by the end of the period.

Figure 1. Solar Analysis Valid 01/1815UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

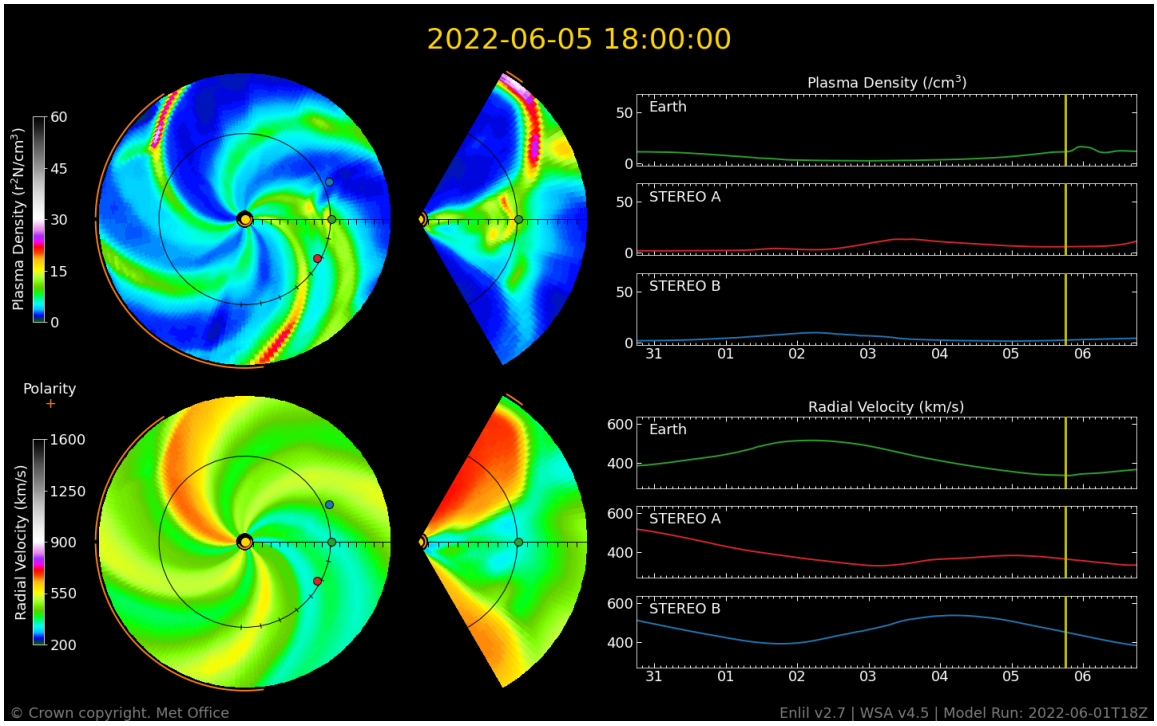
Geomagnetic Storms:
A filament lift-off was observed from the centre disc around 01/0100 UTC, with an associated coronal dimming. A weak CME was produced and seen weakly in available coronagraph imagery. This has been analysed and is a fairly weak and relatively slow, but gives a slight chance of a glancing blow late on day 4 (5th June), but with low confidence.

Solar winds are expected to be at background levels throughout the period. A weak coronal hole in the centre disc (CH86/-) is no longer identifiable, and hence any enhancement from this feature has been dropped from the forecast.

Geomagnetic activity is forecast to be predominately Quiet throughout the period, with a slight chance of an Unsettled or Active interval late on day 4 (5th June) if we see a glancing blow from a fairly weak and slow CME at Earth.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	1	1	1	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: Enlil showing a slight chance of a glancing blow from a weak and slow CME possibly arriving late on day 4 (5th June). Low confidence.



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

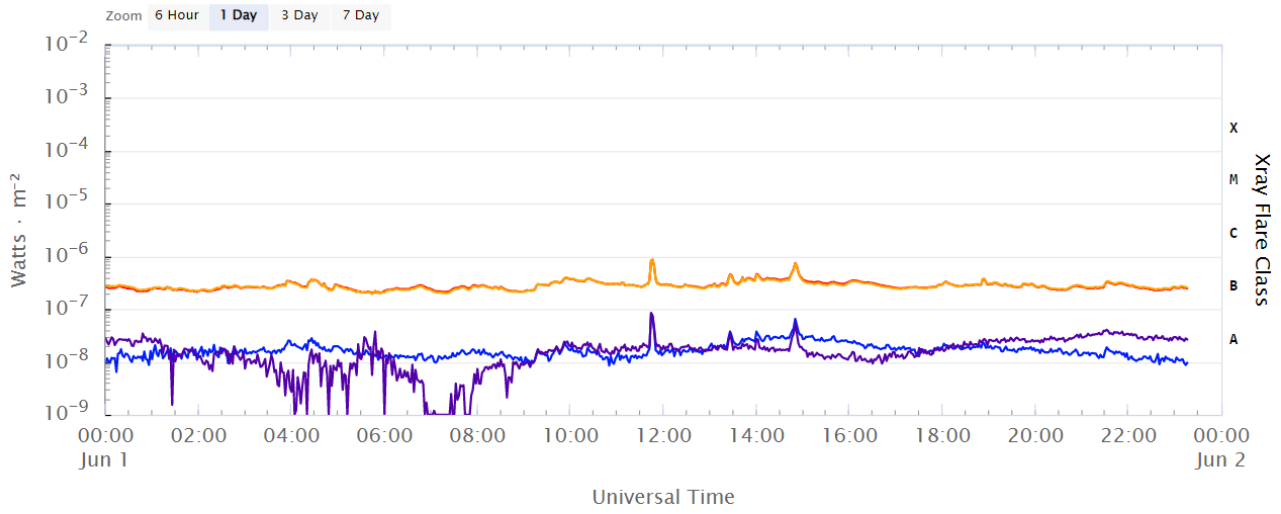
© Crown Copyright 2022. All Rights Reserved.

Radio Blackouts - X-Ray Flares:

There are four numbered regions on the disc. Activity has remained Very Low for the last 24 hours, however the development of AR3026 Dai/Beta which has seen rapid growth in the last 12 hours increased the potential for flaring. However, this region remains small with a relatively straightforward magnetic structure. The newly numbered AR3027 in the southeast has continued to show further growth and is now classified as a Dao/Beta configuration. Otherwise AR3024 Hsx/alpha and AR3023 Hax/alpha remain simple and stable regions. AR3025 has now rotated off the disc and around the western limb. Overall activity is likely to be Very Low with a chance of rising to Low, with C-class flares, primarily from AR3026 and AR3027 with a slight chance of rising to Moderate due to the low risk of M-flares.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	15	15	10	10
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: GOES-16 X-ray flares.



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

Solar Radiation Storms - (High Energy Protons):
The high energy proton flux (greater than 10 MeV) is at background levels and is most likely to remain so through the period, with no significant regions on, or expected to rotate onto, the visible disc.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	2	2	2	2
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

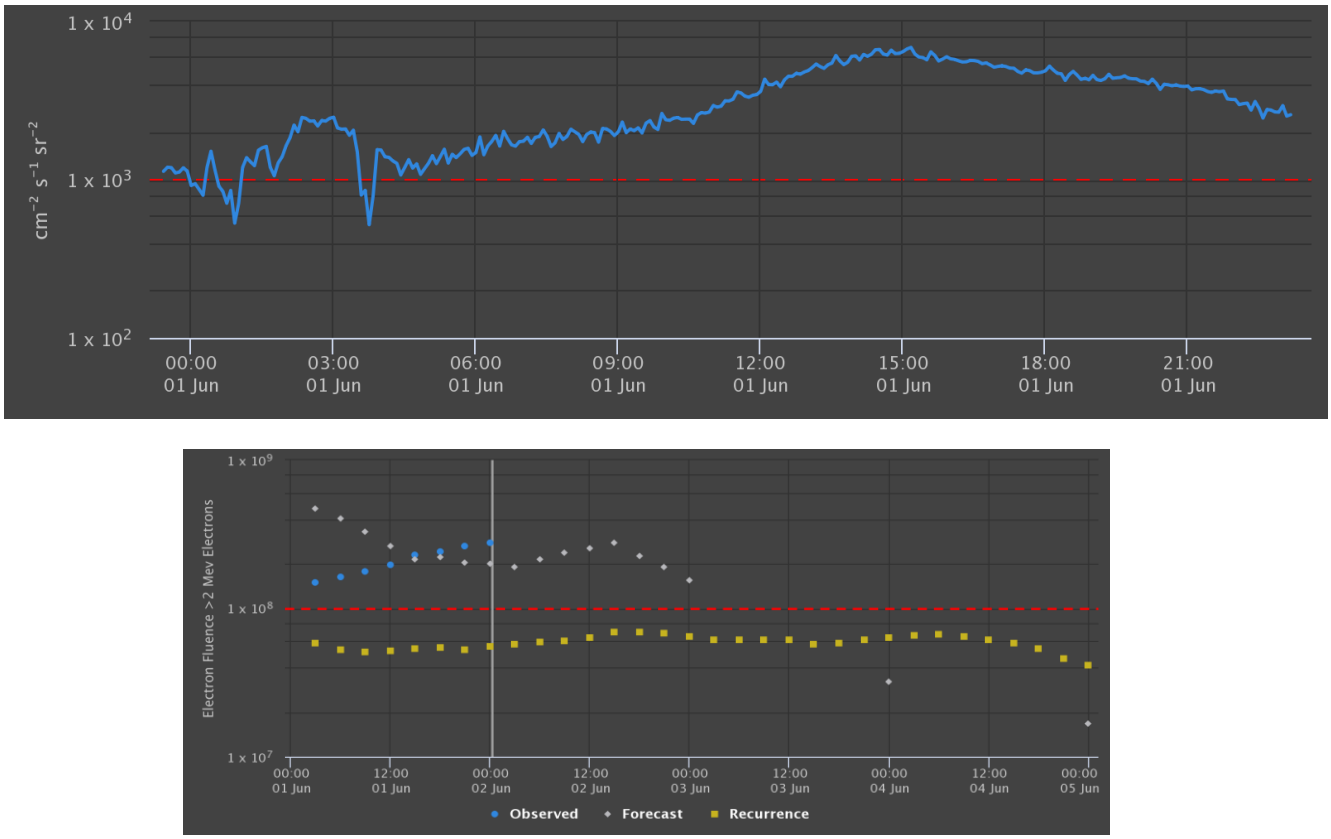
© Crown Copyright 2022. All Rights Reserved.

High Energy Electrons Event (≥ 2MeV):
The high energy electron flux (greater than 2MeV) as observed by GOES-16 has generally been at High (greater than 1000pfu) due to the recent fast wind enhancement. With no further notable disturbances forecast for the solar wind environment around Earth, these mainly High levels are expected to persist, although peak values are likely to decline gradually through the period with more prolonged periods of Moderate levels possible at the daily minimum.

The associated 24 hour electron fluence is currently Active (greater than 1e8) and expected to persist at this level through the period, but with a slightly increasing chance of falling below by day 4 (4th). This is supported by REFM for the initial 24 hours, however beyond this REFM is likely reducing values too quickly.

GEO Electron Environment Probability (Exceedance)	Level ($cm^{-2}\,sr^{-1}\,day^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	Yes	100	80	60	40
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 4: GOES-16 Electron Flux (top) and REFM electron fluence (bottom)



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.